

CLAIMS

1. A friction stir welding method for a lap joint, in which a plurality of members are lapped and a welding tool is pressed into one of the members, while being rotated, to cause friction stir to achieve welding, characterized in that the method comprises using, as the welding tool, a welding tool having a small diameter projected part at a tip end of a shoulder, and pressing the projected part and the shoulder of the welding tool into one of the members.
2. The friction stir welding method according to claim 1, characterized in that the small diameter projected part is semispherical in shape.
3. The friction stir welding method according to claim 2, characterized in that a recess is provided on the shoulder around the projected part.
4. The friction stir welding method according to claim 1, characterized in that an outer peripheral surface of a tip end of the shoulder of the welding tool is inclined to define an inclined surface.
5. The friction stir welding method according to claim 1, characterized in that an outer peripheral surface of a tip end of the shoulder of the welding tool is rounded.
6. The friction stir welding method according to any one of claims 1 to 5, characterized in that the welding tool is pressed into one of the members and a welding boundary surface is activated and welded by

plastic flow, in which such pressing causes the member to be discharged to an outer periphery of the welding tool.

7. A friction stir welding method for a lap joint, in which a plurality of members are lapped and a welding tool is pressed into one of the members, while being rotated, to cause friction stir to achieve welding, characterized in that a tip end of the welding tool is semispherical in shape.

8. The friction stir welding method according to claim 7, characterized in that only a part of the semispherical shaped portion of the welding tool is pressed into the member to make a contact angle between the welding tool and a surface of the member an acute angle.

9. The friction stir welding method according to claims 7 and 8, characterized in that the welding interface is activated and welded by causing the member to undergo plastic flow.

10. A friction stir welding method for a lap joint, in which a plurality of members are lapped and a welding tool is pressed into one of the members, while being rotated, to cause friction stir to achieve welding, characterized in that a tip end of the welding tool is flat and an outer peripheral surface thereof is rounded.

11. The friction stir welding method according to claim 10, characterized in that the whole of the flat

portion of and only a part of the rounded portion of the welding tool are pressed into the member.

12. The friction stir welding method according to claims 10 and 11, characterized in that a welding interface is activated and welded by causing the member to undergo plastic flow.

13. The friction stir welding method according to any one of the preceding claims, characterized in that the welding tool is pressed into the member to cause friction stir of the member and then pulled out to perform spot welding.

14. The friction stir welding method according to any one of claims 1 to 12, characterized in that the welding tool is moved in a direction of welding in a state, in which the welding tool is pressed into the member.

15. The friction stir welding method according to any one of the preceding claims, characterized in that lapped surfaces of the plurality of members are coated with soft metal.

16. The friction stir welding method according to claim 15, wherein the soft metal is any one of nickel, zinc, and copper.

17. The friction stir welding method according to any one of claims 1 to 16, characterized in that a trapezoidal member is provided on a surface of the member on that side, into which the welding tool is pressed, to prevent an indentation produced due to

pressing of the welding tool.

18. The friction stir welding method for a lap joint, according to any one of claims 1 to 17, characterized in that one of the members is provided on a lapped surface thereof with a groove, the other of the members is provided on a lapped surface thereof with a projected part, and the projected part is fitted into and welded to the groove.

19. A friction stir welding apparatus that rotates a welding tool to cause friction stir to weld a plurality of members, characterized in that a tip end surface of the welding tool defines a convex-shaped and curved surface.

20. A friction stir welding apparatus that rotates a welding tool to cause friction stir to weld a plurality of members, characterized in that the welding tool comprises, at a central portion of a tip end thereof, a projected part having a smaller diameter than that of the welding tool and a tip end of the projected part defines a curved surface.

21. A friction stir welding apparatus that rotates a welding tool to cause friction stir to weld a plurality of members, characterized in that the welding tool comprises, at a central portion of a tip end thereof, a projected part and a recess is formed around the projected part.

22. A friction stir welding apparatus that rotates a welding tool to cause friction stir to weld a

plurality of members, characterized in that the welding tool comprises a tip end shaped to be trapezoidal in cross section transverse to an axial direction thereof.